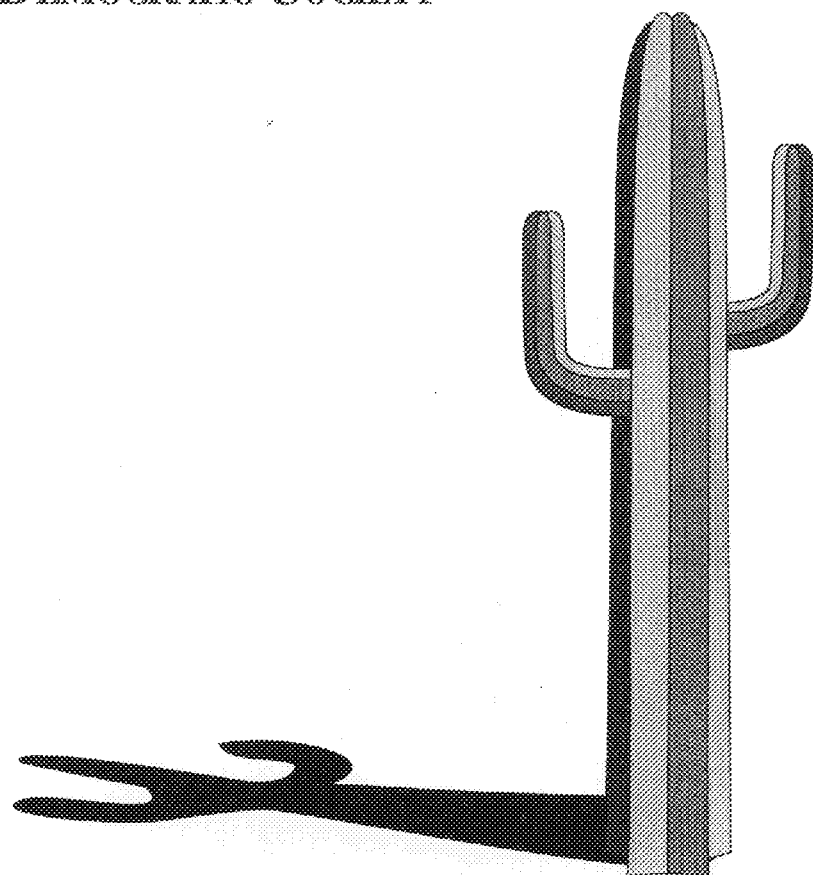


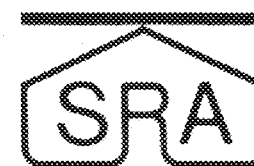
ASSESSING AND MANAGING RISKS IN A
DEMOCRATIC SOCIETY



PHOENIX, ARIZONA

SOCIETY FOR RISK ANALYSIS

FINAL PROGRAM AND ABSTRACTS



ANNUAL MEETING AND EXPOSITION

HILTON SOUTH MOUNTAIN

DECEMBER 6-9, 1998

SUNDAY, DECEMBER 6

4:00-7:00 PM
Registration
W. REGISTRATION DESK

5:30-6:30 PM
Welcome Reception
WEST GARDEN

MONDAY, DECEMBER 7

8:00 AM-4:00 PM
Registration
W. REGISTRATION DESK

8:30-10:00 AM
Plenary Session -- *Cultural
Legacies: Shaping the
Future of Risk Analysis*
S. MOUNTAIN BALLROOM

10:00 AM-4:00 PM
Exhibits
CORONADO/CORTEZ

NOON-1:30 PM
Lunch - *Lester Lave; 1998
Distinguished Achievement
Awardee*
S. MOUNTAIN BALLROOM

SONORA

Monday

10:30 am - noon
1-Toxicological Data & Expert
Judgment... - Poster Platform

1:30 - 3:00 pm
11-Symposium: Use of Risk
Information in Business ...

3:30 - 5:00 pm
21-Risk and the Armed Forces

Tuesday

8:30 - 10:00 am
31-Stakeholders in Risk Man-
agement - Pt 1

10:30 am - noon
41-Stakeholders in Risk Man-
agement - Pt 2

1:30 - 3:00 pm
51-Approaches to Risk Assess-
ment & Risk Mgmt- Pt 1

3:30 - 5:20 pm
61-Approaches to Risk Assess-
ment & Risk Mgmt- Pt 2

KACHINA

Monday

10:30 am - noon
2-Risk Communication - Poster
Platform

1:30 - 3:00 pm
12-Risk Analysis in the Courts

3:30 - 5:20 pm
22-Symposium: Similarities and
Differences in Chemical ...

Tuesday

8:30 - 10:00 am
32-Risk Perception - Poster Plat-
form

10:30 am - noon
42-Mechanism-Motivated Mod-
eling - Poster Platform

1:30 - 3:00 pm
52-Symposium: Trust - Pt 1

3:30 - 5:00 pm
62-Symposium: Trust - Pt 2

SAGUARO 1

Monday

10:30 am - noon
3-Risk Communications in
Democratic Decision-Making

1:30 - 3:00 pm
13-Effects of Risk Communica-
tion

3:30 - 5:20 pm
23-Media Coverage of Risk

Tuesday

8:30 - 10:00 am
33-Determinants of Risk Per-
ception

10:30 am - noon
43-Effective Methods of Risk
Communication

1:30 - 3:00 pm
53-Influences of Risk Percep-
tions

3:30 - 5:20 pm
63-Stakeholder Involvement

Wednesday

10:30 am - noon
71-Symposium: Drinking Wa-
ter Communication & Policy

1:30 - 3:00 pm
80-Symposium: Risk & Stigma

SAUGUARO 2

Monday

10:30 am - noon
4-Symposium: Pro-Active Inter-
agency Partnership ... - Pt 1

1:30 - 3:00 pm
14-Symposium: Pro-Active In-
teragency Partnership ... - Pt 2

3:30 - 5:00 pm
24-Symposium: Pro-Active In-
teragency Partnership - Pt 3

Tuesday

8:30 - 10:00 am
34-Symposium: Application of the
Framework ...(FRAMES) - Pt 1

10:30 am - noon
44-Symposium: Application of the
Framework ...(FRAMES) - Pt 2

1:30 - 3:00 pm
54-Attributing Risk: Population
Risk

3:30 - 5:20 pm
64-Symposium: CRESO as an
Experiment in Obtaining ...

Wednesday

10:30 am - noon
72-Role of Risk Assessment in
Resolving Liability Disputes

1:30 - 3:00 pm
81-Inhalation Exposure &
Markers

PALO VERDE 1

Monday

10:30 am - noon
5-Symposium: The Balance of
Nature - Can Toxicologists ...

1:30 - 3:00 pm
15-Engineering Systems - Risk
Issues

3:30 - 5:20 pm
25-Looking to the Future

Tuesday

8:30 - 10:00 am
35-Modeling Exposure Over
Global Ranges

10:30 am - noon
45-Symposium: Rats! (Rodent
Bioassays & Risk Assessment)

1:30 - 3:00 pm
55-Ecological Risks: Multiple
Stressors & Multiple ...- Pt 1

3:30 - 5:20 pm
65-Ecological Risks: Multiple
Stressors & Multiple ...- Pt 2

Wednesday

10:30 am - noon
73-Communicating Health
Risk

1:30 - 3:00 pm
82-Symposium: Risk Educa-
tion

PAVO VERDE 2		MOHAVE		PUEBLO		AZTEC		PAPAGO		TUESDAY, DECEMBER 8	
Monday		Monday		Monday		Monday		Monday		8:00 AM-4:00 PM Registration W. REGISTRATION DESK	
10:30 am - noon		10:30 am - noon		10:30 am - noon		10:30 am - noon		10:30 am - noon		10:00 AM-4:00 PM Exhibits CORONADO/CORTEZ	
9-Symposium: Assessing Farm-to-Table Risks of E. Coli...		7-Setting Thresholds and Uniform Standards		8-Multi-Disciplinary Issues in Cancer Risk Assess: L3...		9-Risk Perception Across Cultures		10-Distributional Analysis		NOON-1:30 PM Lunch - Business Meeting S. MOUNTAIN BALLROOM	
1:30 - 3:00 pm		1:30 - 3:20 pm		1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm			
16-Symposium: A Risk Assessment of Salmonella ... - Pt 1		17-Setting Priorities for Regulatory Decision Making		18-Symposium: Are Traditional Uncertainty Factors Large...		19-Risk Communications & Environmental Decision Making		20-Predicting Target Tissue Dose			
3:30 - 5:00 pm		3:30 - 5:20 pm		3:30 - 5:00 pm		3:30 - 5:00 pm		3:30 - 5:20 pm			
26-Symposium: A Risk Assessment of Salmonella ... - Pt 2		27-New Approaches to Decision Making		28-Symposium: Probabilistic Methods in Aggregate and ...		29-Formulating Effective Risk Messages		30-Symposium: Aggregate Exposure Assessment for Pesticides ...			
Tuesday		Tuesday		Tuesday		Tuesday		Tuesday		WEDNESDAY, DECEMBER 9	
8:30 - 10:00 am		8:30 - 10:00 am		8:30 - 10:00 am		8:30 - 10:00 am		8:30 - 10:00 am		8:00 AM-NOON Registration W. REGISTRATION DESK	
36-Symposium: Uncertainty Analysis in QRA: Strengths ...		37-Risk, Science and Law: Toxic Injury Litigation - Pt 1		38-Symposium: Good Risk Assessment Practices: Making ...		39-Symposium: Assessing & Managing Risks Under ... - Pt 1		40-Symposium: Implementation of the RPA of 1996 ... - Pt 1			
10:30 am - 12:20 pm		10:30 am - noon		10:30 am - noon		10:30 am - noon		10:30 am - 12:20 pm		8:30 AM-NOON Plenary Session - <i>Assessing and Managing Risks: Science, Public Values, and the Marketplace</i> S. MOUNTAIN BALLROOM	
46-Integrating Risk Assessment & Benefit/Cost Analysis		47-Risk, Science and Law: Toxic Injury Litigation - Pt 2		48-Microbial Risk		49-Symposium: Assessing & Managing Risks Under ... - Pt 2		50-Symposium: Implementation of the RPA of 1996 ... - Pt 2			
1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm		10:00 AM-NOON Exhibits CORONADO/CORTEZ	
56-Symposium: Dermal Pathway Issues		57-Symposium: Regulatory Improvement I: Policy Issues		58-Symposium: Risk Assessment for Replicating Organisms		59-Alternative Dose-Response Models		60-Heavy Metal Exposure			
3:30 - 5:00 pm		3:30 - 5:00 pm		3:30 - 5:00 pm		3:30 - 5:00 pm		3:30 - 5:00 pm			
66-Use of Internet Resources for Risk Communication		67-Risk Assessment: A Burning Issue in Regulatory Reform		68-Chemical, Microbes and the Balance		69-Evaluating Alternatives for Regulatory Decision Making		70-Symposium: Dose-Response Relationships in Occupational			
Wednesday		Wednesday		Wednesday		Wednesday		Wednesday			
GRAND CANYON		NAVAJO		HOPI		PIMA		APACHE			
10:30 am - noon		10:30 am - 12:20 pm		10:30 am - noon		10:30 am - noon		10:30 am - noon			
74-Public Perception - Public Participation - Pt 1		75-Reconsidering Cancer Risk		76-Food Consumption - Poster Platform		77-Symposium: Toward a Quantitative Definition ... - Pt 1		78-Symposium: Performing Risk Assessments When ... - Pt 1		79-Symposium: The Relationship of Economics and	
1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm		1:30 - 3:00 pm			
83-Public Perception - Public Participation - Pt 2		84-Symposium: Time as a Risk Metric		85-Symposium: Toward a Quantitative Definition ... - Pt 2		86-Symposium: Performing Risk Assessments When ... - Pt 2		87-Methods in Probabilistic Risk Assessment			

10:30 am - Noon

Room: Sonora

Toxicological Data & Expert
Judgment in Case-Specific Risk
Characterization - Poster Platform

Chair: L. Rhomberg

1.01 Cancelled

1.02 Is TCDD a Threshold Carcinogen? A
Quantitative Analysis of the Epidemiological
Data. C. R. Kirman, S. M. Hays, L. Aylward,
N. J. Karch, D. J. Paustenbach; *ChemRisk*;
Karch & Associates1.03 Using Expert Elicitation to Develop a
Quantitative Risk Assessment for Methylene
Chloride. M. L. Gargas, C. R. Kirman, P.
Dugard, S. M. Hays; *ChemRisk*; *Halogenated Solvents Industry Alliance*1.04 Reproductive Hazard Identification:
Findings and Limitations in Studies of Women
Exposed to Benzene. A. J. Dunn, L. Zeise, M.
Golub; *Office of Environmental Health Haz-
ard Assessment, California*1.05 UVB-Induced Immunomodulation:
Estimation of the Health Risk. J. Garssen, W.
Slob, H. Van Loveren; *National Institute of
Public Health and the Environment, The
Netherlands*1.06 Discussion on Harmonisation of Uncer-
tainty Analysis in Human Health Risk Assess-
ment. T. G. Vermeire, H. Stevenson, M. N.
Pieters, W. Slob, B. C. Hakker; *National In-
stitute of Public Health and the Environ-
ment, The Netherlands*; *TNO Nutrition and
Food Research Institute, The Netherlands*1.07 The Data-Generating Process for Mea-
sures of Relative Toxicity: Implications for Risk
Assessment. K. P. Brand, L. Rhomberg, J. S.
Evans; *Harvard SPH*

10:30 am - Noon

Room: Kachina

Risk Communication - Poster
Platform

Chair: J. Till

2.01 RF Safety: Creating Culturally Neutral
Risk Communications on Wireless Base Sta-
tions. J. E. Ebrgott, D. T. Sean; *Lucent Tech-
nologies*2.02 Risk Communication in Practice - A
Case Study in Western Australia. M. E.
Farinha; *Curtin University of Technology,
Australia*

2.03 Moved to 80.04

2.04 The Mt. Pinatubo Experience-How Third
World Politics Characterizes Risk. C. R.
Villamin; *Science and Technology Informa-
tion Institute, Philippines*2.05 Why Humans are So Bad at Interpret-
ing Probabilities. S. Ferson, L. R. Ginzburg;
*Applied Biomathematics; State University of
NY, Stonybrook*2.06 Managing Pandora's Open Box: Label-
ing as Risk Displacement. S. H. Priest; *Texas
A&M University*2.07 Environmental Risk Communication
and Decision Making: Lesson Learned from
the Real World. M. C. von Braun; *Univer-
sity of Idaho*

10:30 am - Noon

Room: Saguaro 1

Risk Communications in Demo-
cratic Decision-Making

Chair: J. M. Gutteling

10:30 3.01
The Systematic Planning of Risk Communi-
cation: The Next Step. J. M. Gutteling; *Uni-
versity of Twente, The Netherlands*10:50 3.02
Tackling Risk Perception within the Demo-
cratic Process: A Canadian Case Study. C. M.
Purtill, M. H. Flowers; *Radian Interna-
tional, Canada; Radian International
LLC, New Mexico*11:10 3.03
Three Examples of Public Participation in
Environmental Decision Making. S. L. Sharp,
J. E. Till; *BP Oil Company; Risk Assessment
Corporation*11:30 3.04
Facts and Values: Characterizing Analytical
Perspectives in Environmental Risk Debates.
T. J. Keating; *Harvard University*

10:30 am - Noon

Room: Saguaro 2

Symposium: Pro-Active Interagency
Partnership to Address Perchlorate
Contamination - Part ICo-Chairs: A. Jarabek and D.
Rogers10:30 4.01
Overview and History of Perchlorate: Forma-
tion of the Interagency Steering
Committee(IPSC). D. Rogers; *Air Force Ma-
terials Command*10:50 4.02
Occurrence of Perchlorate in Groundwater
and Surface Water Supplies in the United
States. K. P. Mayer; *US EPA, San Francisco*11:10 4.03
Stakeholder Identification and Involvement
on Perchlorate Issues. C. M. McCracken; *US
EPA, San Francisco*

10:30 am - Noon

Room: Palo Verde 1

Symposium: The Balance of Nature:
Can Toxicologists and Ecologists
Come to Consensus?

Chair: S. Ferson

10:30 5.01
Straining the Gnat and Swallowing the
Camel: The Importance of Scale and Uncer-
tainty in Assessing Ecological Risk. T. S.
Bridges; *US Army Corps of Engineers*10:50 5.02
Gleaning Ecological Risks from Sediment
Toxicity Tests. B. L. McGee; *Wye Research
and Education Center*11:10 5.03
Competing Issues in Contaminated Site Risk
Assessment: A Case Study. S. M. Hoover, R. A.
Hill; *Golder Associates, Canada; Triton En-
vironmental Consultants, Ltd., Canada*11:30 5.04
A New Diet of Worms: Ecologists, Toxicolo-
gists, and Regulators. B. K. Hope; *Oregon
Department of Environmental Quality*

1:30 - 3:00 pm

Room: Sonora

Symposium: Use of Risk Information in Business Decisions*Chair: L. Rudenko*

1:30 11.01
A Reasonable Person Standard for the 21st Century: The Legal Connection Between Risk and Action in a Business Decision Context. *N. S. Bryson; Crowell & Moring*

1:50 11.02
Incorporating Risk Concepts Into Performance-Based Building and Fire Regulation Development: Phase I - Conceptual Approach. *B. J. Meacham; Society of Fire Protection Engineers*

2:10 11.03
The Nature of Business Risk. *K. R. MacCrimmon, M. L. Martens; University of British Columbia, Canada*

2:30 11.04
Unintentional Chemical Exposures from Consumer Products at Various Stages in Product Life Assessment and Management of Potential Risks by Business Decision Makers. *L. Rudenko, G. P. Thompson; Environ International Corporation*

1:30 - 3:00 pm

Room: Kachina

Risk Analysis in the Courts: - Poster Platform*Co-Chairs: J. Applegate and W. E. Wagner*

The Risk Science and Law Specialty Group's annual Poster Session will showcase fourteen posters that summarize over 100 court cases involving issues related to risk assessment. During the session, the authors will be available to discuss specific cases or categories of cases with other SRA members. A reduced copy of the entire set of posters will be available upon request.

1:30 - 3:00 pm

Room: Saguario 1

Effects of Risk Communication*Chair: P. Williams*

1:30 13.01
Evaluating Risk Communication: In Search of a Gold Standard. *J. K. Hammitt; Harvard School of Public Health*

1:50 13.02
Risk Perceptions, Environmental Values, and Willingness to Address Climate Change. *R. E. O'Connor, R. J. Bord, A. Fisher; Pennsylvania State University*

2:10 13.03
A Conceptual Framework for Assessing the Effect of Risk Communication on Consumer Purchasing Decisions. *R. L. Beekman, L. Blake-Hedges; US EPA, Washington, DC*

2:30 13.04
Physician Communication with Patients Regarding Risks of Side Effects in Cancer Clinical Trials. *T. L. Albrecht, D. Eaton, L. Rivera, R. Strongbow, C. Blanchard, J. Ruckdeschel; University of South Florida; Albany Medical College; H. Lee Moffitt Cancer and Research Institute.*

1:30 - 3:00 pm

Room: Saguario 2

Symposium: Pro-Active Interagency Partnership to Address Perchlorate Contamination - Part 2*Co-Chairs: A. Jarabek and D. Rogers*

1:30 14.01
Targeted Toxicity Testing Program to Revise Provisional RfD for Perchlorate. *A. M. Jarabek, D. R. Mattie; US EPA, RTP, NC; US Air Force*

1:50 14.02
Pharmacokinetic Modeling Considerations for Examining Perchlorate Induced Inhibition of Iodide Uptake in the Thyroid Gland. *J. W. Fisher, K. Yu; US Air Force*

2:10 14.03
Independent External Peer Review of Perchlorate RfD and Toxicity Studies. *P. C. Grevatt; US EPA, Washington, DC*

2:30 14.04
Transport, Transformation, and Ecological Risk Assessment of Perchlorate. *G. C. Long, R. C. Porter, M. D. Sprenger, C. Callahan; US Air Force; US EPA, Edison, NJ and San Francisco, CA*

1:30 - 3:00 pm

Room: Palo Verde 1

Engineering Systems - Risk Issues*Chair: S. H. Levinson*

1:30 15.01
Challenges in the Management of Faster-Better-Cheaper Space Missions and Analytical Tools for Decision Support. *E. Paté-Cornell, R. Dillon; Stanford University*

1:50 15.02
The Use of Unsatisfactory Condition Reports in the Reliability Data Development for the Space Shuttle Main Engine. *J. Swider, Z. Huang; The Boeing Company*

2:10 15.03
Potential Health Risks from Urban Infrastructure Activities. *R. Zimmerman; New York University*

2:30 15.04
An Approach for Quantifying the Risk of Injury from Toys. *C. Doran, T. Xu; ITS Risk Analysis & Management*

3:30 - 5:00 pm

Room: Sonora

Risk and the Armed Forces

Chair: G. B. Briggs

3:30 21.01
The Use of Risk Assessment in Navy Deployment Toxicology. *G. B. Briggs, W. Alexander, K. R. Still; US Air Force*

Cancelled * 21.02

3:50 21.03
U.S. Coast Guard R&D Projects in Support of Risk-Based Decision Making. *K. A. Hansen; US Coast Guard R&D Center*

3:30 - 5:20 pm

Room: Kachina

Symposium: Similarities and Differences in Chemical and Radiation Risk Management

Chair: N. Tran

3:30 22.01
Introduction. *N. Tran; Johns Hopkins University*

3:50 22.02
Harmonizing Chemical and Radiation Risk-Reduction Strategies: A Science Advisory Board Commentary. *D. Barnes, S. L. Brown; US EPA, Washington, DC, Risks of Chemical Compounds (R2C2)*

4:10 22.03
Incorporating Tribal Ecological Cultural Perspectives into Environmental Assessment and Management. *B. Harper, S. G. Harris; Yakima ER/WM Program, Confederated Tribes of the Umatilla Indian Reservation*

4:30 22.04
Radiation and Chemical Risk Management: Comparing and Contrasting Legal Approaches to Public Health Protection. *P. Locke; Environmental Law Institute*

4:50 22.05
Workshop Addressing the Similarities and Differences in Chemical and Radiation Risk Management. *D. O'Connor, US EPA, Washington, DC*

3:30 - 5:20 pm

Room: Saguaro 1

Media Coverage of Risk

Chair: R. J. Griffin

3:30 23.01
Audience Seeking and Processing of Information About Risks to the Great Lakes Ecosystem. *R. J. Griffin, S. Dunwoody, K. Neuwirth, J. Giese; Marquette University; University of Wisconsin Madison; University of Cincinnati*

3:50 23.02
Danger! Toxic Reporting: A Case Study of the Benzene Barge Spill on the Mighty Mississippi. *S. F. Dube; University of South Carolina*

4:10 23.03
Newspaper Coverage of Risk at Two Major US Nuclear Weapons Sites: A Content Analysis. *L. M. Waishwell, K. Lowrie; CRES*

4:30 23.04
The Media, The Public and EPA's Draft Dioxin Report. *S. M. Friedman, B. Egolf; Lehigh University*

4:50 23.05
Should Reporters Use Risk as a Determinant of Environmental Coverage? *D. B. Sachsman; University of Tennessee*

3:30 - 5:00 pm

Room: Saguaro 2

Symposium: Pro-Active Interagency Partnership to Address Perchlorate Contamination - Part 3

Co-Chairs: A. Jarabek and D. Rogers

3:30 24.01
Status of Inter-Laboratory Analytical Methods Validation Study. *D. T. Tsui; US Air Force*

3:50 24.02
Treatment Technologies for Perchlorate Reduction. *E. T. Urbansky; US EPA, Cincinnati, OH*

4:10 24.03
Perchlorate: Policy and Regulatory Considerations Under the Safe Drinking Water Act Amendments of 1996. *M. T. Osinski; US EPA, Washington, DC*

4:30 Panel Discussion

3:30 - 5:00 pm

Room: Palo Verde 1

Looking to the Future

Chair: M. McElwaine

Cancelled 25.01

3:30 25.02
Why the Society for Risk Analysis Should Debate Policies for Regulation of Very Long Term Risk. *D. Okrent; University of California, Los Angeles*

3:50 25.03
Assessing Preferences for Environmental Decisions with Long-Term Consequences. *T. Eppel, J. Guyse, L. R. Keller; Decision Insights, Inc.; University of California, Irvine*

4:10 25.04
Adaptability of Environmental and Occupational Protections Systems to Major Societal Change: Lessons from the Polish Experience. *H. S. Brown, D. Angel, P. Derr; Clark University*

4:30 25.05
Managing Long-Term Risk Through Stewardship: A Stakeholder Approach. *D. J. Sarno; International Association for Public Participation*

Symposium Descriptions

Monday, December 7

Symposium 4 - PRO-ACTIVE INTERAGENCY PARTNERSHIP TO ADDRESS PERCHLORATE CONTAMINATION - PART 1

Within months following the April, 1997, development of a low level detection methodology, perchlorate had been discovered at various manufacturing sites as well as in well-water and the drinking water supplies in California, Nevada, Utah, and Arizona. The contamination is of concern because of existing uncertainties in (1) the toxicological data base for quantifying health effects; (2) the actual extent of perchlorate in ground and surface waters, which is compounded by some uncertainty in the validation of the analytical detection method; (3) the efficacy of different treatment technologies for various water uses such as drinking water or agricultural application; and (4) the extent and nature of its ecological impact or transport and transformation phenomena in various environmental media. Critical information in all these areas must be integrated in order to characterize the risk of perchlorate contamination and in order to formulate appropriate management strategies to mitigate potential risk. The charter of the Interagency Perchlorate Steering Committee (IPSC), formed in January 1998, was to serve as a forum to bring together government representatives from the EPA, Department of Defense (DoD), Agency for Toxic Substances and Disease Registry (ATSDR), National Institute for Environmental Health Sciences (NIEHS), and affected state, tribal, and local governments. Stakeholder issues meetings have been hosted by the IPSC to ensure that their issues and concerns are identified and to provide technology transfer so that all affected parties and concerned citizens are apprized of accurate and reliable information that is up to date with the evolving state-of-the-science. This symposium will describe how the IPSC has worked as a collaborative process as well as provide keynote presentations in each of the critical areas to the requisite integrated approach. The topic should be of local interest in Arizona and a panel discussion session is planned.

Symposium 5 - THE BALANCE OF NATURE: CAN TOXICOLOGISTS AND ECOLOGISTS COME TO CONSENSUS?

The subject of the proposed symposium is the difference of perspectives of toxicologists and ecologists about the consequence of homeostasis of organisms and other stability mechanisms in natural communities. Toxicologists often view these mechanisms as a cushion against toxicological insults.

Ecologists on the other hand, are more likely to view the balance of nature as an unstable one, which can be destroyed by toxicant effects.

The goals of the symposium are to highlight the differences of two communities and to illustrate ways to resolve disagreements to achieve a synthetic assessment of ecotoxicological risks.

Symposium 6 - ASSESSING FARM-TO-TABLE RISKS OF E. COLI O157:H7 IN HAMBURGER

Risk assessment models are useful for identifying where pathogens enter the food processing chain. This session uses pathway and probabilistic scenario analysis to identify how E. coli O157:H7 contaminates hamburger and causes disease. This pathogen is of great interest to the public because it targets children and can cause kidney failure and death. By identifying high-risk pathways and

production and consumption behaviors, risk analysis can serve as a foundation for evaluating control options to reduce illness associated with hamburgers.

This session focuses on risks throughout the farm-to-table chain and examines practices on the farm, during live-animal-transit, at the slaughterhouse, and from processing to consumption. The evidence is examined to estimate the contributions of various scenarios to human illness. The results are from the work of the Interagency Food Safety Risk Assessment Group (IFRAG) and will be presented in four modules beginning with the farm and progressing to human illness. For each contributing factor, the risks will be quantified or qualitatively estimated at the various stages of the farm-to-table chain.

Symposium 8 - MULTI-DISCIPLINARY ISSUES IN CANCER RISK ASSESSMENT: 1,2-BUTADIENE CASE STUDY

This case study provides an opportunity to focus on interdisciplinary issues in risk assessment including the role and interpretation of epidemiology studies; the incorporation of detailed laboratory data to define mechanisms of action; and the significance of new data that affect exposure assessment. 1,3-Butadiene is a chemical of importance to the rubber and plastic industries. Occupational exposure to 1,3-butadiene has been reported to be associated with lymphohematopoietic cancers. The results of animal studies have demonstrated significant interspecies differences with regard to metabolism, genotoxicity and carcinogenicity. Recently, EPA (1998) performed a cancer risk assessment for this chemical based on occupational data. However, there are a number of unresolved issues that should be considered in the human health risk assessment for 1,3-butadiene. These issues include: the significance of species differences in metabolism, genotoxicity and carcinogenicity; the incorporation of mechanistic data in the risk assessment approach; limitations of the available epidemiological data and the fulfillment of causal criteria; and the reliability of current exposure assessment. This symposium reviews the current knowledge on 1,3-butadiene, and discusses the impact of the unresolved issues on the cancer risk assessment for this chemical.

Symposium 11 - USE OF RISK INFORMATION IN BUSINESS DECISIONS

Historically, risk assessment has been applied in a post hoc fashion to remediate existing environmental or occupational settings. Its utility as a proactive decision-facilitating framework, however, has grown in recent years. In this Symposium, we focus on four different aspects of the proactive use of risk analysis, looking at the legal aspects of implementation of risk analysis in the presence or absence of regulatory constraints, the use of risk analysis in developing building codes, and how businesses define, evaluate, and use risk concepts in making decisions whether they are driven by financial or technical constraints.

Symposium 14 - PRO-ACTIVE INTERAGENCY PARTNERSHIP TO ADDRESS PERCHLORATE CONTAMINATION - PART 2

See description for Part 1.

Symposium 16 - RISK ASSESSMENT OF SALMONELLA ENTERITIDIS IN EGGS AND EGG PRODUCTS - PART 1

The Food Safety and Inspection Service initiated a comprehensive risk assessment of Salmonella Enteritidis to respond to the increasing incidence of human illnesses attributed to egg con-

sumption. The Salmonella Enteritidis Risk Assessment identifies the risk of foodborne illness from SE, potential risk reduction strategies, and data needs for further research. The risk assessment was completed by a multi disciplinary team of scientists from government and academia. The comprehensive farm to table model developed led to the following findings: Prevalence of SE positive flocks and positive eggs in the United States, surveillance multipliers to estimate the occurrence of SE in the United States, prediction of growth of SE in shell eggs, construction of a dose response equation for exposure to SE in humans, survival of Salmonella Enteritidis bacteria in egg products after pasteurization, and determination of the number of Salmonella Enteritidis bacteria in an egg at lay.

Symposium 18 - ARE TRADITIONAL UNCERTAINTY FACTORS LARGE ENOUGH? IS THE PRODUCT OF UNCERTAINTY FACTORS TOO LARGE?

Subject: The setting of allowable levels of human exposure to toxic substances (*e.g.*, RfD's, ADI's, SMAC's) involves the reduction of experimentally observed or estimated exposure levels by various numerical factors to account for variability and lack of knowledge. This symposium will address the degree of "safety" that these "uncertainty factors" ensure.

Goals: (1) To explore the degree of uncertainty actually captured by traditional values of uncertainty factors, (2) To investigate whether the simple multiplication of factors is appropriate for representing the overall uncertainty from various sources.

This symposium will bring together Dose-Response Assessment and Risk Characterization, with the goal of improving Risk Perception/Communication in Regulatory Policy and Decision Making.

Symposium 22 - SIMILARITIES AND DIFFERENCES IN CHEMICAL RADIATION RISK MANAGEMENT

This symposium will discuss the findings of a national workshop, co-sponsored by the Environmental Law Institute (ELI) and the Johns Hopkins University Risk Sciences and Public Policy Institute (JHU RSPPI) and sponsored by the Environmental Protection Agency Office of Radiation and Indoor Air (EPA ORIA). The workshop was held in Annapolis, Maryland on June 8 & 9, 1998. It brought together a diverse group of federal, state and tribal risk managers and other individuals with risk management and risk assessment experience. Experts in radiation and chemical risk management participated in panel discussions, breakout groups and plenary sessions that were facilitated by ELI, JHU RSPPI and EPA ORIA personnel.

The workshop resulted in the identification of specific similarities and differences in radiation and chemical risk management and under what circumstances, if any, they can be harmonized. It also identified opportunities for harmonization, such as institutional controls, broader involvement by interested parties, and risk assessment methodologies. The workshop cataloged situations in which harmonization may not be appropriate.

The goals of this symposium are to (1) report the findings of the workshop; (2) request feed-back and input from those who attend the symposium; and (3) continue the important dialogue on chemical and radiation risk management and risk assessment. In particular, those who attend the symposium will have the opportunity to discuss whether, and to what extent, radiation and chemical risk assessment are similar and whether opportunities for harmonization exist.

Symposium 24 - PRO-ACTIVE INTERAGENCY PARTNERSHIP TO ADDRESS PERCHLORATE CONTAMINATION - PART 3

See description for Part 1.

Symposium 26 - RISK ASSESSMENT OF SALMONELLA ENTERITIDIS IN EGGS AND EGG PRODUCTS - PART 2

See description for Part 1.

Symposium 28 - PROBABILISTIC METHODS IN AGGREGATE AND CUMULATIVE RISK ASSESSMENTS

The Food Quality Protection Act of 1996 requires the US EPA to consider not only all exposure pathways (aggregate assessments) but also all exposures from pesticides with common mechanism of toxicity (cumulative assessments). The Agency has published a draft document describing EPA's policies for probabilistic exposure assessments. Current practice in risk assessment is to apply probabilistic methods to exposure assessments only. However, in its final report on the open meeting held in March 24-25, 1998, the FIFRA Scientific Advisory Panel concluded that it is appropriate for the agency to move toward probabilistic techniques for toxicity endpoints. Scientists from the US EPA, academia, and industry will discuss some of these methods and the associated data requirements.

Symposium 30 - AGGREGATE EXPOSURE ASSESSMENT FOR PESTICIDES: IMPLEMENTING FQPA

The Food Quality Protection Act of 1996 (FQPA) defined a new standard of safety for pesticide tolerances as "reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue, including all anticipated dietary exposures and all other exposures for which there is reliable information." Regulatory exposure assessments traditionally have focused on a single source and/or route of exposure. FQPA has stimulated the rapid development of new methods to integrate pesticide exposures from multiple sources (diet, water, indoor and outdoor residential applications) and by multiple routes (ingestion, inhalation, dermal absorption). The ILSI Risk Science Institute held a workshop* in February 1998 to present and examine some of these new methods. The proposed symposium at the SRA December 1998 meeting will continue that discussion, exploring the progress made in the two years since the enactment of FQPA and the critical scientific problems that remain. Perspectives from government (EPA), industry (a major pesticide chemical manufacturer), academia, and the consultant community will be presented. The multidisciplinary nature of aggregate exposure assessment will be highlighted, encompassing complex but very practical issues in distributional analysis using Monte Carlo techniques, characterization of temporal, regional, and demographic patterns of exposure, relating the exposure assessment to the toxic effect of concern, dealing with data limitations and the problem of "non-detects," and application of value-of-information methods. These issues are being addressed in "real time" as the regulatory decision-making process moves forward at an increasing pace. [*Supported by a cooperative agreement with the U.S. Environmental Protection Agency, CR 825501-01]

ship by eliciting risk and benefit judgments of a range of hazards under a time-pressure condition. For judgments made when time was limited, we expected the use of deliberative thought to be reduced, and reliance on affective reactions to hazards to be increased. The results showed that individuals' risk and benefit judgments of 20 hazards were more strongly negatively correlated under a time-pressure condition (mean $r = -0.37$) than a no time-pressure condition (mean $r = -0.12$), supporting the notion that a common affective pool is accessed for both risk and benefit judgments. That is, the confounding between perceived risk and perceived benefit seems to be stronger when the opportunity for careful consideration of hazardous activities and technologies is restricted. The theoretical and practical implications of our findings will be discussed. [*Work supported in part by the Department of Psychology, University of Western Australia, Perth]

Fischbeck, P. - Carnegie Mellon University, Pittsburgh, PA Follin, J. N. - Carnegie Mellon University, Pittsburgh, PA. **PUBLIC PERCEPTION OF PROJECTS INVOLVING HUMAN HEALTH, ECOLOGICAL, AND QUALITY-OF-LIFE IMPACTS**

Twelve major project types were examined to determine the public's perception of their associated impacts and attributes. These twelve project types were the most common ones analyzed in Environmental Impact Statements (EISs). Data was obtained on the public's perception of the actual impacts relative to twelve different categories (e.g., land use and noise levels); psychometric attributes for the positive and negative aspects of the projects; and overall perceived impact of the project. This data is compared with EISs to determine how the public perception differs from a sampling of typical projects. Three major findings were discovered. First, the public's view of the overall impact for a project type agrees well with the actual projects except for timber for which the public had a more negative perception. Second, there are some specific impacts where the public does not appear to understand how a project affects the environment. For example, the public believed air quality would worsen with an expanded airport; whereas, the actual calculations indicated air quality would improve with improved air and ground traffic flow. Third, when predicting the public's overall perception of a project, it appears that the psychometric variables are more important than the perceived individual impacts. A two-factor regression, using positive and negative factors with combined attributes of knowledge, observability, duration, and immediacy, produced $r^2 > 0.9$.

Fisher, Ann N. - Pennsylvania State University, 107 Arnsby Building, University Park, PA 16802. **STAKEHOLDER INVOLVEMENT IN ASSESSING REGIONAL IMPACTS FROM CLIMATE CHANGE**

Building on regional workshops held during 1997 and 1998, 20 assessments of potential regional impacts from climate change are being conducted within the United States. Federal agencies with responsibilities related to climate change are providing most of the funding for these assessments. Unlike many federal initiatives, however, stakeholder involvement plays a key role in a) defining the questions to be investigated, b) identifying data sets useful for assessing potential impacts within the region, and c) designing and disseminating information about the assessment process and regional results. The time frame for conducting the regional assessments is compressed by the need for a draft report in April 1999, so that results can be synthesized into a national assessment due to Congress by the end of 1999. The mandate for a substantial stakeholder involvement role, combined with the short time frame for the assessment, make this undertaking especially challenging from the perspectives of both risk analysis and risk communication. The Mid-Atlantic Regional Assessment (MARA) was among the first to begin. Using MARA as a case study, this paper will

summarize how stakeholders were identified and involved throughout the assessment process. It will describe the evaluation methods and measures leading to lessons learned. [Work supported primarily by U.S. Environmental Protection Agency]

Fisher, J.W. and Kung Yu, Operational Toxicology Branch, Bldg 79, 2856 G St., Wright Patterson AFB, OH. 45415. **PHARMACOKINETIC MODELING CONSIDERATIONS FOR EXAMINING PERCHLORATE INDUCED INHIBITION OF IODIDE UPTAKE IN THE THYROID GLAND**

The working hypothesis concerning potential toxicity of ammonium perchlorate is that the perchlorate ion interferes with production of thyroid hormones (T3 and T4) by inhibiting or significantly diminishing iodide uptake in the thyroid gland resulting in hypothyroidism if perchlorate treatment continues. Iodide is concentrated in the thyroid from the blood by an active transport protein called a symporter located at the basolateral membrane of the thyroid gland. The perchlorate ion competes with the iodide ion at the symporter because of its similarities in ionic size and charge and as a result the perchlorate ion replaces the iodide ion and is shunted into the thyroid gland. Utilizing receptor kinetic theory, a physiological model is proposed to quantitatively describe the relationship between administered perchlorate dose, perchlorate dose at the symporter, and inhibition of uptake of iodide in the thyroid gland of the rat. Kinetic experiments will be carried out in the rat with iodide and perchlorate, both individually and in combination, to discern the kinetics of perchlorate induced inhibition of iodide uptake in the thyroid. Inhibition of iodide uptake will be examined under conditions when the thyroid hormones are undisturbed by a single dose of perchlorate and when thyroid hormones are depleted from repeated doses of perchlorate. A physiological model for iodide and perchlorate will be developed in the rat to interpret recently conducted rodent toxicity studies with perchlorate.

Fleishman B.S.; Independent Risk Analysis Consultant, 2261, 63 St. Brooklyn, NY. 11204. **PROBABILISTIC METHODS OF RISK ESTIMATING AND RISK CONTROL. MINIMIZING COST OF ACCEPTABLE RISK ACHIEVEMENT.**

Probabilistic safety criteria (SC) are based on the quantitative risk estimations. S.Kaplan's Bayesian approach to this task is based on the following: general definition of risk as the triplet: Risk=(Scenario, Likelihood, Consequence); broadened interpretation of the Bayes theorem; decision rules using Theory of Inventive Problems Solution (TRIZ). The above risk estimation and minimization of damage (as a harmful event's consequence) compose the indivisible heuristic algorithm which does not use the notion of acceptable risk R_a . The Bayesian approach is effective at the later stage of the SC development, while our approach is effective on the early stage because it requires less information. We estimate risk based on the following: narrowing the definition of risk as a harmful event probability; decomposition of the general optimization problem into two connected, but independently decided parts. Those parts are: deductively building SC as classical decision rule which uses notion of acceptable risk; and minimizing cost of achievement it. This paper only discusses the second of the above parts. We define risk control as minimizing cost of achievement acceptable risk. For protection of biological systems risk control is based on the empirical function 'efficiency-cost' $K = U \exp(-V \ln X)$, where K is the cost of any protective action, X is the relative intensity of a stressor, U and V are non-negative constants. If the action relates to reduction of the stressor's intensity C , then its relative intensity is defined by relation $X = C'/C$, where C' is the reduced value of stressor's intensity as a result of the action. Let resource K is to be allocated between A actions M_i ($i=1, \dots, A$). Each action

Jager, T. - National Institute of Public Health and the Environment (RIVM), Bilthoven, The Netherlands
Rikken, M.G.J. - National Institute of Public Health and the Environment (RIVM), Bilthoven, The Netherlands
Van der Poel, P. - National Institute of Public Health and the Environment (RIVM), Bilthoven, The Netherlands
Vermeire, T.G. - National Institute of Public Health and the Environment (RIVM), Bilthoven, The Netherlands.
FEASIBILITY OF PROBABILISTIC METHODS IN RISK ASSESSMENT OF INDUSTRIAL CHEMICALS IN THE EU

Both human and ecological risks are expressed as deterministic quotients of the (estimated) exposure and an appropriate effect or no-effect level. This is not truly a risk measure as no attempt is made to estimate the severity and incidence of toxic effects and, furthermore, feelings of uncertainty are usually tackled by introducing worst-case assumptions in the methodology. From a scientific viewpoint, it is advisable to deal more quantitatively with uncertainties in a probabilistic risk assessment. For risk managers, the question is whether probabilistic methods will actually lead to better decision making instead of just increasing the workload and potentially confusing the risk management process. It is therefore of utmost importance that the results of a probabilistic assessment are easily interpretable. The methods for risk assessment of new and existing industrial chemicals are harmonized between the EU Member States and laid down in Technical Guidance Documents (TGDs). These TGDs were subsequently implemented in a decision-support system (EUSES). In this paper, several options for probabilistic risk assessment of chemicals are presented, discussed and illustrated by sample calculations with EUSES. These options have been discussed with risk managers from several EU Member Countries and European chemical industry to investigate their usefulness and feasibility on a longer term.

Jarabek, A.M. and Mattie, D.R.; National Center for Environmental Assessment, U.S. EPA, Research Triangle Park, NC 27711 and Operational Toxicology Branch, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH 45433-7400.
TARGETED TOXICITY TESTING PROGRAM TO REVISE PROVISIONAL RfD FOR PERCHLORATE

In March 1997, the existing clinical and toxicity database on perchlorate was determined by an expert peer review panel to be inadequate as the basis for quantitative health risk assessment. Given the need for an accurate risk estimate with which to characterize the health risk of potential exposure scenarios from environmental contamination with perchlorate, efforts were immediately initiated to obtain key toxicity data in order to revise the provisional RfD previously released by the U.S. EPA's Superfund Technical Support Center. The existing provisional RfD derivation had utilized the existing data and various uncertainty factors, but the known mode-of-action and suggested other target tissues of perchlorate motivated recommendations for additional studies to address potential toxicity previously uncharacterized. Perchlorate had been used clinically to treat hyperthyroidism due to Graves' disease. The basis for the effect on thyroid hormone function is the competitive inhibition of iodide uptake into the thyroid gland which then results in reduce hormone production. Thus, there was concern that developmental toxicity, notably neurological development due to hypothyroidism during pregnancy, could be a critical effect. The genotoxic effects would also need to be assayed in order to characterize the potential for thyroid neoplasia via direct or indirect actions. Eight additional studies were recommended at another peer review meeting in order to provide a comprehensive array of endpoints and targeted mechanistic data to serve as the basis for a more robust health risk assessment. This presentation will describe the process for data development, the rationale for the testing program, and the integration of the results into a revised RfD for perchlorate.

How the RfD undergirds the overall risk characterization strategy and potential refinements using future results of ongoing research will also be discussed.

Jardine, C.G., Hrudey, S.E., Gibson, N.; Environmental Health Sciences, University of Alberta, Edmonton, AB T6G 2G3 and Dept. of Human Ecology, University of Alberta, Edmonton, AB T6G 2M8 Canada.
DRINKING WATER ODOURS AND HEALTH RISK PERCEPTION*

A telephone survey and focus group session were conducted in 1997 to evaluate the detection of odour and health risk perception of drinking water. Forty-two people who have volunteered for several years as drinking water "home sniffers" during spring runoff conditions in Edmonton, Alberta were surveyed to assess personal experiences and concerns about odour and taste in drinking water. While 76% had experienced an odour or taste in drinking water that concerned them, only 29% of these expressed specific concern about potential health risks. A targeted focus group discussion was subsequently conducted with several of the individuals expressing specific health risk concerns. The focus group participants all proved to be well-informed on health risk issues related to drinking water. Everyone agreed that a detectable odour or taste in drinking water doesn't necessarily mean it is not safe to drink, while acknowledging that a lack of a detectable odour or taste does not necessarily connote safety. The primary concern of the participants was the lack of detailed information available to them on the quality of their drinking water, particularly during taste and odour events. All stated that better information on the cause of an off-flavour would serve to greatly reassure them of the water safety. The results obtained from this focus group illustrates the error in the approach of many drinking water utilities, who prefer not to release specific information on off-flavours on the premise that the public would not understand the information or that such information would serve only to create additional apprehension about safety. *(Work supported by the Tri-Council Secretariat representing the Medical Research Council, the Natural Sciences and Engineering Research Council and the Social Sciences and Humanities Research Council of Canada, as well as the Alberta Heritage Foundation for Medical Research, Alberta Health, Alberta Environmental Protection and the City of Edmonton)

Jaworska, J.S. Procter & Gamble, Eurocor, Temselaan 100, B-1853 Strombeek-Bever, Belgium, Aldenberg, T. RIVM, P.O.Box 1, NL-3720 BA Bilthoven, The Netherlands.
ESTIMATION OF HAZARDOUS CONCENTRATIONS FROM BIMODAL SPECIES SENSITIVITY DISTRIBUTIONS USING BAYESIAN STATISTICS.

The sensitivity of biological species for toxicants has been modeled through fitting unimodal statistical distributions to NOEC, or LC50, data sets. Quality objectives can be calculated by estimating percentiles, so-called Hazardous Concentrations, at which a fraction of 5% of the species is affected at the most. For estimating the Fraction Affected at some given or predicted environmental concentration, the method is used inversely by calculating values of the cumulative sensitivity distribution. Since toxicity data sets tend to be small, the estimation of the uncertainty, either through Classical confidence statistics or Bayesian statistics, is an essential part of the assessment process. For pesticides, unimodal distributions may not be appropriate, since many pesticides are developed for certain target species, so that the toxicity data may be distributed in a bimodal or multi-modal way. Using a single mode distribution including data for insensitive species may lead to an overestimation of the risk involved. One way to model bimodality is to employ mixtures of two unimodal distributions. The simplest model involves five parameters: two means, two standard deviations, and a weighting

Environmental Response, Compensation, and Liability Act. Heightened awareness about the hazards of radiation led to the Congress to amend the Atomic Energy Act (AEA) to dissolve the Atomic Energy Commission and create the Nuclear Regulatory Commission and the Energy Research and Development Administration, which became the Department of Energy in 1977. This patchwork of laws and the regulations, cobbled together during the past five decades, creates challenges for risk managers.

This presentation will discuss the development of the legal bases of radiation and chemical risk management. It will highlight how contrasting regulatory techniques have sometimes been used to reach the common goals of protecting public health and conserving societal resources. Based on the information obtained for, and generated at, the workshop organized by the Environmental Law Institute and Johns Hopkins University Risk Sciences and Public Policy Institute, opportunities for harmonization within the current legal framework will also be examined.

Locke, P.; Environmental Law Institute, 1616 P Street NW, Suite 200, Washington, DC 20036; Burke, T.; Rohde, C.; Samet, J.; and Groopman, J.; Johns Hopkins University School of Hygiene and Public Health, 615 North Wolfe Street, Baltimore, MD 21205. **LINKING MOLECULAR EPIDEMIOLOGY AND RISK SCIENCE: APPLICATIONS FOR EXPOSURE ASSESSMENT**

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This presentation will explore the advantages and disadvantages of using biological markers in exposure assessment by examining the use of cotinine, a metabolite of nicotine and a common marker for environmental tobacco smoke (ETS) exposure. A model for asthma exacerbation, introduced in a 1992 ETS Risk Assessment prepared by the United States Environmental Protection Agency (EPA), employed cotinine as an exposure marker to correct for potential misclassification. This model will be reviewed and updated. In particular, this presentation will discuss: (1) model verification and validation through biomarker data; (2) the importance of the distribution of biomarker measurements (3) the effect of differences in biological marker measurement methodologies; and (4) the most productive ways in which a biological marker such as cotinine can be incorporated into exposure assessment. Epidemiologic studies employing biological markers contain valuable information for risk assessors and the use of molecular epidemiology in risk assessment is increasing. As biological marker data is further integrated into risk assessment practice, the benefits and barriers of such information must be fully explored. An iterative process that realistically incorporates biomarker data will help improve the scientific basis of, and build public confidence in, risk assessment.

Löfstedt, R.E., Centre for Environmental Strategy, University of Surrey, Guilford, Surrey GU2 5XH, UK. Phone 01483 259096, Fax 01483 259394, Email R.Lofstedt@surrey.ac.uk **SWEDEN'S LOVE CANAL: TRUST, RISK AND THE HALLANDSÅS DISASTER.**

Since 1991 the Swedish government via Banverket have tried together with several entrepreneurs to build a high speed 17 kilometre railroad tunnel through the Hallandsås horst. To date Banverket and the entrepreneurs (at first Kraftbyggarna and more recently Skanska) have been unsuccessful. The horst formed 65-100 million years ago contains crevices and cracks which are filled with water and the ridge itself contains large supplies of groundwater. Through the entire tunnel building period the entrepreneurs have faced difficulties of how best to cope with the massive amounts of water leaking into the tunnel – they have lowered the water table, installed various flushing mechanisms and, in the fall of 1997, Skanska decided to use the chemical sealant Rhoca-Gil to halt the water flow. However, the water flows were so high that the sealant leaked into the ground water causing widespread contamination leading to fish deaths, poisoning of cows and considerable

worry among the local residents. In this paper, I examine the public's perceptions of risk in the affected community (Båstad). Among the questions that I will discuss are: are the public concerned about the risks posed by using Rhoca-Gil? Do the public trust the Government's message that the water is now safe to drink? Do the public believe that Skanska were ignorant of the potential dangers of using Rhoca-Gil? The study, funded by grants from the Swedish Ministry of Transport and the Swedish Council for the Planning and Coordination of Research, is based on a one year content analysis of all the local papers in the affected region as well as a random telephone survey of 100 citizens in Båstad.

Long, G.C., Porter, R.C., USAF, Det 1, HSC/OEMH, 2402 E Drive, Brooks AFB, TX 78109, Sprenger, M.D., USEPA-OSWER-OERR-ERTC, 2890 Woodbridge Ave, Bldg 18 (MS-101), Edison, NJ 08837, Callahan, C., USEPA Region 9, 75 Hawthorne St. (SFD-8B), San Francisco, CA 94105. **TRANSPORT, TRANSFORMATION, AND ECOLOGICAL RISK ASSESSMENT OF PERCHLORATE.**

Perchlorate salts are quite soluble in water. The resultant anion (ClO_4^-) is exceedingly mobile in aqueous systems and can persist for many decades under typical groundwater and surface water conditions due to kinetic barriers to its reactivity with other available constituents. This mobility and persistence may pose a threat to ecological receptors and whole ecosystems, either by direct toxicity to organisms, or by indirectly affecting their ability to survive and reproduce. Currently, there are little data to evaluate the effects of perchlorate on ecological systems or agricultural products through irrigation of the food crops. Analytical tests have been derived to detect perchlorate in water, but little is known about testing food crops for perchlorate. A recent literature search conducted by the USAF identified and assessed factors such as solubility, adsorption, biodegradation, chemical reactions, dispersion, diffusion, and other processes affecting environmental transport and transformation of perchlorate. The USAF is currently pursuing field validation of these parameters to better understand what the potential receptors may be and what factors increase or inhibit the mobility of perchlorate. Additionally, a search of available databases has revealed minimal information on the ecological effects of ammonium perchlorate or any of its other salts. Little data exists to describe its effects on various soil, sediment or aquatic receptors including aquatic vertebrates, aquatic or sediment invertebrates, bacteria or plants. The USAF and USEPA developed a proposal for a battery of screening level bioassays in laboratory-reared organisms representative of ecological receptors across soil, sediment, and water column receptors to evaluate dose-response relationships. The identified tests focused on identifying gross (direct) toxicity tests whose endpoints can include mortality, growth, and reproductive success. The results of these tests were used to develop dose-response information and form approaches for more sophisticated assessments.

Long, J., Fischhoff, B., Florig, K., Morgan, G., Dekay, M., Fischbeck, P., Department of Engineering and Public Policy, Carnegie Mellon University, Baker Hall 129, 5000 Forbes Ave, Pittsburgh, PA 15213. **SIMULATION OF ATTENTION AND RESOURCES ALLOCATION IN RISK RANKING. ***

Risk ranking is an important procedure for helping risk managers to allocate their attention and society's resources in a sensible fashion. Previous studies on risk ranking have been largely, methodologically, focusing on how to bring groups together to reach some degree of consensus, or descriptive, focusing on the experiences of such efforts. The research reported here focuses on the prescriptive question of how the attention and resources should be allocated within risk ranking, whether conducted by citizen groups or technical analysts. The research use a simulation model

change of risk over time, and the effects of positive, negative and neutral discounting of future risk will be presented.

Mayer, K.P. U.S. EPA Region 9, 75 Hawthorne St., Mail Code SFD-7-2, San Francisco, CA 94105-3901. **OCCURRENCE OF PERCHLORATE IN GROUNDWATER AND SURFACE WATER SUPPLIES IN THE UNITED STATES.**

At least thirteen separate sources of perchlorate contamination of groundwater were discovered in California within a few months of developing an improved analytical method. Detectable levels of the contaminant have been measured in more than 110 public water supply wells in California. Shortly after the groundwater contamination was recognized, low levels of perchlorate were found in the Colorado River downstream of perchlorate manufacturing facilities in Nevada. More than 15 million people in California, Nevada, Arizona and Native American Tribes rely on this irreplaceable source of water. As the analytical method became known outside California, perchlorate was confirmed in water in Utah and Texas and investigations are under way in several other states. Perchlorate has been manufactured or shipped to solid rocket fuel and explosives facilities in nearly every state in the US. The potential threat to water resources warrants a concerted, systematic effort to identify and examine possible sources of perchlorate contamination throughout the country.

McCracken, C.M. U.S. Environmental Protection Agency Region 9, 75 Hawthorne Street (SFD-3), San Francisco, CA 94105-3901. **STAKEHOLDER IDENTIFICATION AND INVOLVEMENT ON PERCHLORATE ISSUES.**

EPA and the other agencies involved in rapidly emerging perchlorate issues face a major challenge in identifying, communicating with, and involving stakeholders. Stakeholders are defined as parties which are affected by a particular issue(s) and/or which can affect a particular issue(s). Much of the interest in perchlorate came initially from agencies, groups and individuals active at specific Superfund sites where perchlorate was discovered. EPA's Office of Community Involvement facilitates stakeholder communication at Superfund sites in Region 9. The level of interest in perchlorate issues has spread beyond the boundaries of particular sites and to a diverse range of parties. An Interagency Perchlorate Steering Committee (IPSC) was formed in January 1998 to facilitate information sharing. Although IPSC meetings and conference calls were open to any interested party, there was continued criticism for insufficient communication with advocates for children's health, environmental justice communities and Native American tribes, among others. An IPSC-sponsored Perchlorate Stakeholders Forum was held in Henderson, Nevada in May 1998, and more than 1,000 people from Region 9 and other states were directly invited to attend. The 200+ participants had a wide range of concerns, but were consistent in their desire for more communication and an open process in gathering and assessing information. This session will cover stakeholder analysis, purpose of the perchlorate stakeholders forum, and issues/lessons learned at the forum, and future stakeholder involvement activities, with time included for questions and discussion with audience members.

McComas, K.A. Cornell University, Department of Communication, 203 Kennedy Hall, Ithaca, NY 14853. **SPEAKING ABOUT RISK: THE IMPACTS OF PUBLIC MEETINGS ON PARTICIPANTS' RISK PERCEPTIONS.**

One of the most common and traditional ways to involve citizens in risk assessment and management is to hold a public meeting—an approach that clearly embodies certain ideals held dear to democratic societies, such as free speech and the right to assembly. Yet public meetings are also frequently criticized for some stereotypical weaknesses, including rigid communication formats, overly technical presentations, or incendiary comments from the audience. Aside from anecdotal accounts, however, relatively little real analysis documents these “weaknesses” or investigates their potential impacts on decisions about risk. In particular, how does the information—both formal and informal—that citizens receive at public meetings impact their risk perceptions? To investigate whether public meetings amplify or attenuate risk perceptions, this study uses a panel design that compares risk perceptions of citizens before and after they attend public meetings. In the spring of 1998, residents in two New York communities facing waste management decisions received mailed surveys designed to measure risk perceptions, degrees of involvement, knowledge levels, and assessments of source credibility. Those surveyed included a census of residents previously attending public meetings about the waste sites and a stratified sample of residents living within one mile of the waste sites. High response rates for both groups in both communities (an average of 89% for the census and 55% for the stratified sample) indicate high issue salience among respondents. The second round of data collection will take place after the next public meetings are held in each community during the summer of 1998. Questions added to the second round allow citizens who attended the public meetings to evaluate the meetings' formats, technical presentations, and discussions. Participant observations of the meetings will complement the quantitative results.

McDaniels, T.L. - Eco-Risk Research Unit, Institute for Resources and Environment, Vancouver, B.C., Canada. **TEN PROPOSITIONS FOR UNTANGLING DESCRIPTIVE AND PRESCRIPTIVE LESSONS IN RISK PERCEPTION FINDINGS**

Trust can be built among communities of experts by seeking greater clarity in the purposes and interpretation of analysis. Psychometric risk perception findings are among the most insightful and widely cited, and undoubtedly the most controversial, of the social science research efforts on technological risks. This paper argues that the controversy arises because of an inability to distinguish between the descriptive and prescriptive lessons to be drawn from risk perception studies. Ten propositions about risk perception studies and how to interpret their descriptive and prescriptive implications are provided. The discussion draws on examples from recent ecological risk perception studies and from prescriptive studies involving structured judgement as inputs to analytical comparison of risk management alternatives.

McDougal, JN - Geo-Centers Inc., AF Research Laboratory, 2856 G Street (AFRL/HEST), WPAFB OH 45433, Weisman, WH - Operational Toxicology Branch (AFRL/HEST), AF Research Laboratory, WPAFB OH 45433. **IMPORTANCE OF SKIN CONCENTRATION IN ASSESSING DERMAL ABSORPTION POTENTIAL**

Traditionally, flux measurements from in vitro diffusion cells have focused on the amount of chemical in the receptor solution and ignored the amount of chemical remaining in the skin. For many chemicals the amount of chemical in the skin can be important because it can subsequently be absorbed. We wondered how much difference including the amount of an organic chemical in the skin would make in the flux calculation, so we developed a method for including skin concentrations in the flux determination during diffusion cell studies. Dibromomethane was applied to the skin from

ther “nonbelievers” who will take no initiatives themselves and oppose all government efforts, nor “believers” who promise both to make personable efforts and to vote for every government proposal. Second, there are separate demographic and attitudinal sources for voluntary actions compared with voting intentions. Third, recognizing the causes of global warming is a powerful predictor of behavioral intentions independent from believing that climate change will happen and have bad consequences. Finally, the success of the risk perceptions variables to account for behavioral intentions should encourage greater attention to risk perceptions as independent variables. [*Work supported by National Science Foundation under Grant SRB-9409548 and the U.S. Environmental Protection Agency under Cooperative Agreement CR 824369-01]

Okrent, D., School of Engineering and Applied Science, University of California, Los Angeles, CA 90095-1597. **WHY THE SOCIETY OF RISK ANALYSIS SHOULD DEBATE POLICIES FOR REGULATION OF VERY LONG TERM RISK.**

There has been essentially no debate within the Society of Risk Analysis of the government regulations for disposal of hazardous materials that pose very long-term risk, that is, for thousands of years or more. There exists a huge disparity in the stringency of USEPA regulations for the geologic disposal of long-lived, high-level radioactive wastes and the cleanup and disposal of carcinogenic elements such as arsenic, chromium and nickel, which never decay. The time horizon for regulation of radioactive wastes is currently 10,000 years, and the permissible societal and individual lifetime risk is small. The time horizon for cleanup and disposal of non-radioactive, very-long-lived, non-radioactive hazardous materials is generally 100 years or less. Using USEPA methodology and parameters, analyses have found that subsistence farm families living above some abandoned Superfund sites or RCRA sites hundreds or thousands of years in the future could readily suffer a lifetime risk of unity of contracting cancer from the residual carcinogens. Is such a disparity proper? Are intergenerational equity considerations being met for the hazardous chemical waste sites? What should societal policy be regarding acceptable or tolerable risks arising hundreds or thousands of years in the future from the activities of the current generation? Why? Should there be vastly different policies regarding risks to future generations because of the different manner in which the public appears to perceive the risks today from different technologies or different wastes? Is this rational, and if so, why? [*Work supported in part by the UCLA Academic Senate]

O’Ryan R - República 701, Santiago, Chile Díaz M - Domeyko 2361, Santiago, Chile. **UNCERTAINTY ANALYSIS IN THE REGULATIONS ASSESSMENT : THE CASE OF ARSENIC IN CHILE**

At the present, the major regulatory agencies in the world recommend the use of the deterministic methods for the analysis of the problems related with making decisions. However, this approach does not incorporate the uncertainty in the variables, neither its propagation through the distinct processes in which they intervene. With it, the complexity of the problem is reduced arbitrarily and itself valuable information is not properly used for the definition of realistic policies that, together with protecting the health, are technically feasible and economically reasonable. In this job the results of a deterministic analysis are compared with the results of a probabilistic analysis for the regulation of arsenic in Chile. Specifically, we investigate if an uniform quality standard is appropriate as instrument to regulate environmental problems, or if is preferably an emission standard. It is concluded that the use of a deterministic method can carry to apply environmental standard too much restrictive upon considering only average values. Additionally, those variables whose uncer-

tainty have the most important influence in the total uncertainty are examined, and therefore it permits to define how the resources for future investigations should be allowed.

Osinski, M.T. U.S. EPA, 401 M St., S.W. Mail Code 4607, Washington, D.C., 20460. **PERCHLORATE: POLICY AND REGULATORY CONSIDERATIONS UNDER THE SAFE DRINKING WATER ACT AMENDMENTS OF 1996.**

Congress enacted The Safe Drinking Water Act (SDWA) in 1974, amending it in 1986 and 1996. SDWA provides the basis for safeguarding public drinking water systems (PWS) from contaminants posing a threat to public health. EPA is mandated to protect public health by ensuring PWS provide tap water that is safe for drinking and bathing, and is accomplished by promulgating National Primary Drinking Water Regulations (NPDWR) to control the level of harmful contaminants in drinking water. The 1996 amendments significantly changed the process by which contaminants are identified and selected for regulation. The requirement that EPA regulate 25 contaminants every three years was replaced with a risk-based prioritization model for contaminant selection, with an emphasis on using the best available, peer-reviewed science in making regulatory determinations for regulate specific contaminants. Under the risk-based model, EPA must publish a list contaminants, after public comment and input from the scientific community, that are known or anticipated to occur in PWS and not currently subject to any NPDWR. This list, known as the Contaminant Candidate List (CCL), will be the source of prioritizing contaminants for research, guidance development, and selection of contaminants for possible regulation or monitoring by the States. EPA must use three criteria to determine whether or not to regulate a contaminant: the contaminant adversely affects human health; it is known or likely to occur in drinking water with a frequency and at levels of public health concern; and regulation of the contaminant presents a meaningful opportunity for health risk reduction. Perchlorate was placed on the CCL as an emerging contaminant of concern. However, serious data gaps exist in the areas of health effects, nationwide occurrence, treatment technologies, and analytical methods. These data gaps create short and long term challenges for EPA in gathering and assessing the scientific data necessary to support and inform the Agency’s decision-making in taking the appropriate regulatory and policy actions.

Otani, J.M. and Proctor, D.M.; ChemRisk, A Service of McLaren/Hart, Inc., Two North Shore Center, Suite 100, Pittsburgh, PA 15212. **USE OF BENCH TOP LABORATORY STUDIES TO QUANTIFY POTENTIAL HEALTH RISKS TO MERCURY VAPORS: A CASE STUDY.**

A human health risk assessment was conducted to evaluate the potential risks to future on-site workers that may be exposed to mercury vapors emanating from subsurface soil. Because the source of mercury (mercuric chloride) was at least six feet below ground surface, the primary exposure pathway of concern was volatilization of elemental mercury vapors. Although elemental mercury was not used at this site, mercurous and mercuric ions exist in equilibrium with elemental mercury. The exact composition is dependent on the oxidative potential of the particular medium in which the element is found. Due to the complex fate and transport characteristics of mercury in soil, a simple exposure analysis was not used. Instead, bench top laboratory studies were conducted by Frontier Geosciences located in Seattle, Washington to quantify the emission rates of elemental mercury from the soil samples. These emission rates were used to calculate a representative mercury air concentration [95% upper confidence limit (95% UCL) for the source area]. The representative air concentration was compared to the United States Environmental Protection Agency’s (USEPA) Region III Risk-Based Concentration (RBC) for inorganic mercury in air to

Rimer, K.A. - US EPA/OAQPS, (MD-15), Research Triangle Park, NC 27711 Pagano, D.A. - US EPA/OAQPS, (MD-15), Research Triangle Park, NC 27711 Hetes, R.G. - US EPA/OAQPS, (MD-15), Research Triangle Park, NC 27711. **SCIENCE POLICY CONSIDERATIONS IN DEVELOPING A RISK-BASED REGULATORY PROGRAM**

Science policy issues arise in many aspects of developing a risk-based regulatory program, from interpreting the legislative mandate, through developing risk management and risk assessment approaches, and in working with stakeholders. Interpreting the science policy aspects of a risk-based legislative mandate leads to an understanding of the program goals and of the underlying process for achieving those goals. The risk management decisions that will be made to reach these goals will be made under uncertainty. In order to make sound decisions across a program there is a need to establish common criteria to be evaluated at each decision point, criteria which acknowledge and consider uncertainty. Applying the best available science in the context of limited public and private sector resources requires balancing data and assumptions, and choosing appropriate models and levels of analytical sophistication for a given analysis. The goal here is to establish a methodology that requires the minimum amount of time and effort to result in outputs that are appropriate for the risk management decision-making process. Science policy issues are also relevant in discussions with stakeholders. Along with the legislative mandate, they form the basis upon which to resolve divergent views on program structure and regulatory requirements. This presentation will summarize the science policy issues that have arisen so far in developing the residual risk program. An open discussion will follow.

Roberts, T., Kuzma, J., Walls, I. Cannon, L.; United States Department of Agriculture (USDA) Economic Research Service, 1800 M Street, NW, Room 3077, Washington, DC 20036, USDA, Food Safety and Inspection Service, Washington, DC 20250 and National Food Processors Association, 1401 New York Avenue, NW # 400, Washington, DC 20005. **SLAUGHTER/PROCESSING MODULE OF THE PATHWAY ANALYSIS TO ASSESS FARM-TO-TABLE RISKS OF E.COLI 0157:H7 IN HAMBURGER.**

The slaughter/processing module is the second stage of the pathway analysis to assess farm-to-table public health risks of E.coli 0157:H7 in hamburger. The purpose of the slaughter/processing module is to simulate the likelihood and level of E. coli 0157:H7 contamination during slaughter and processing of beef. Contamination of the carcass from the hide and/or gastrointestinal tract or cross-contamination from the environment or other animals/carcasses is possible at each step of the slaughtering process: hide removal, evisceration, carcass splitting, chilling, and cutting. The slaughter/processing module may also be used to simulate the effects of specific decontamination strategies such as knife trimming, steam vacuuming, carcass washing, and steam pasteurization.

Rodriguez, R. R., Basta, N.T., Casteel, S. W., Pace, L. W.; Sverdrup Environmental, Inc., 13723 Riverport Dr., Maryland Heights, MO 63043; Oklahoma State University, Dept. of Plant and Soil Sciences, Stillwater, OK 74074; and University of Missouri, Veterinary Medicine Diagnostic Lab., Columbia, MO 65201. **CHEMICAL METHODS TO ESTIMATE BIOAVAILABLE ARSENIC IN CONTAMINATED SOILS AND SOLID MEDIA.***

The ability of chemical methods to estimate bioavailable arsenic in contaminated soil and solid media was evaluated. Chemical methods include an in-vitro method (IVG), that simulates the human gastro-intestinal environment, as well as soil chemical fractionation methods that extract different pools of soil arsenic. Fifteen contaminated soils and solid media, ranging in arsenic con-

centration from 233 to 17,456 mg kg⁻¹, were analyzed by IVG and fractionation methods. Arsenic measured by IVG and fractionation methods were then compared with in-vivo bioavailable arsenic determined from feeding trials using the immature swine model. Arsenic extracted by the IVG stomach phase and intestinal phase were linearly correlated ($r^2 = 0.69$ and 0.67 , respectively) with in-vivo bioavailable arsenic ($P < 0.01$). Analysis of variance showed the IVG stomach phase and intestinal phase were not statistically different from the in-vivo method. Five chemical extractants, ranging from deionized water to very aggressive reagents that dissolve occluded arsenic, were used to fractionate soil arsenic. Results suggest the fraction of bioavailable arsenic in contaminated soils includes desorbable non-occluded forms and some arsenic associated with iron, manganese, and aluminum oxides. Chemical methods may be useful tools to evaluate the bioavailable fraction of arsenic in contaminated materials to lower uncertainty and develop more reasonable estimates of risk. [*Work supported by U.S. EPA Research Grant No. R825410-01-0]

Rogers, Lt Col Dan, USAF, AFMC LO/JAV, 4225 Logistics Ave, Ste 23, Wright Patterson AFB, Ohio 45433. **OVERVIEW AND HISTORY OF PERCHLORATE: FORMATION OF THE INTERAGENCY STEERING COMMITTEE (IPSC).**

Ammonium perchlorate is a component of solid rocket propellant used by the Department of Defense and NASA for space systems. First identified in groundwater in the mid to late 1980's, perchlorate and its' potential health effects had not been evaluated in any extensive or comprehensive way. A provisional RfD was developed by the U.S. EPA in 1992 and again in 1995, serving as the basis for guidance levels of 4 - 18 ppb. In October, 1996, California's Central Valley Regional Water Quality Board issued the first perchlorate cleanup and abatement order to Aerojet General Corporation in Sacramento, California. Levels at or above 400 ppb appeared to be migrating off Aerojet's property and had the potential to affect a public drinking water supply. Analytical method detection limit capabilities dropped in January 1997 from 400 ppb, to 100 ppb and then to 4 ppb in April 1997. Samples taken at that time in the Sacramento area indicated the presence of perchlorate above 18 ppb. As a result, those public drinking water wells were closed. Perchlorate was also identified as a contaminant in drinking water supplies of California, Nevada, Utah, and Arizona. In January, 1998, the Interagency Perchlorate Steering Committee was formed to serve as a discussion forum for technical issues and as a governmental clearinghouse of information to facilitate accurate accounts of technical issues related to groundwater and soil contamination by the chemical perchlorate. Formal membership is limited to government officials (Federal, State, local), and includes representatives from HQ EPA; EPA Region IX; ATSDR; NIEHS; the Department of Defense; the States of California, Nevada and Utah; and representatives from the Colorado River American Indian tribes. This inter-agency partnership is a unique and effective method of communication as part of citizen and stakeholder involvement and of addressing the critical issues of perchlorate environmental contamination, including: occurrence; toxicology and health effects; treatment technology; analytical detection methods; and ecosystem

Rogers, R.E., Whitmyre, G.K., Driver, J.H., Pandian, M.D.; TOXCON Health Sciences Research Centre & risksciencesCANADA, 9607 41st Avenue, Edmonton, Alberta, Canada, T6E 5X7 and risksciences.com, L.L.C., 2111 Wilson Boulevard, Suite 800, Arlington, VA 22201. **INDOOR SIMULATED RESIDENTIAL CHAMBER (SRC) APPROACHES TO EXPOSURE MONITORING, AND RESULTS OF ILLUSTRATIVE STUDIES.**

trations of perchlorate (4 micrograms per liter, ppb) was developed by California Department of Health Services, Sanitation and Radiation Laboratory Branch (SRLB). Since then, numerous commercial and government laboratories have engaged in the development of alternative ion chromatography methods. In April 1998, Dionex Corporation published an alternate ion chromatography method with an even lower limit of detection and enhanced method performance (1 ppb). A recent survey of 45 private, commercial, and government laboratories showed that an increasing number of laboratories have adopted the improved analytical method. Because reported method performance and duplicate field sampling data vary widely, the analytical sub-committee of the Inter-agency Perchlorate Steering Committee (IPSC) is coordinating an inter-laboratory collaborative study to 1.) quantify the bias and uncertainties of existing IC methods and 2.) examine physical and sampling parameters affecting perchlorate analysis. Twenty-five private, commercial, and government laboratories are currently participating in the collaborative study. The objective of the study is to provide inter- and intra-laboratory data pertinent to method performance with respect to water quality (total dissolve solids and pH), concentration dependence, specific ion interference, light, temperature, and holding time. The goal of the study is to provide validated method, physical, and sampling parameters, facilitating the acceptance of perchlorate testing at low concentrations by laboratories across the country.

Tumeo, M.A.; USDA/AAAS Risk Assessment Fellow, Office of Risk Assessment and Cost Benefit Analysis and Director, Center for Environmental Science, Technology and policy, Cleveland State university, 1899 E 22nd St., MC-219, Cleveland, OH 44114. **DEFINING THE INTERFACE BETWEEN ECONOMICS AND RISK ASSESSMENT**

Risk and cost-benefit analyses are both conducted to provide structured information useful for decision making. Neither is "science", though both make use of applied science. Both are subsets of decision or policy analysis. However, since the inception of the use of risk assessment as a decision making tool, there has been tension between the two. Often, risk assessment is seen as "the science" portion of the analysis, with the economic portion being viewed as somehow suspect. There has been a historical perception that economic methods inadvertently or intentionally ignored environmental values. While there are always situations in which an analysis tool is intentionally used incorrectly or in such a way to produce a specific desired result, the real problem lies in the fact that cost-benefit analysis suffers from a long standing problem of how to "value" certain attributes, especially attributes which are not typically subject to market forces, or which have emotional overtones. However, the tension between risk assessment and cost-benefit analysis is not only a function of economic analyses methods. Almost all risk analyses are conducted with little or no interaction with the economic analysts who will eventually conduct the cost-benefit analysis. This separated, non-coordinated approach lends itself to misunderstandings and confusion when the economic analysis is conducted. Secondly, risk assessors often perceive themselves as presenting "the facts" when actually, risk assessment is also riddled with assumptions and its own technical problems. Because of inherent uncertainties in risk assessment, its position in decision making as historically been viewed as overly conservative and based on unrealistic expectations of a risk free society. Ultimately, it is the responsibility of both the risk assessor and the economic analyst to coordinate their analyses so as to provide the best and most complete information to both the public and the decision maker. This does not mean that the tension will be eliminated or even reduced between the two approaches, only that the tension will be a creative and positive aspect of looking at the same problem in two different yet important ways.

Urbansky, E.T. U.S. Environmental Protection Agency, National Risk Management Research Laboratory, Water Supply and Water Resources Division, 26 West Martin Luther King Drive (MS-681), Cincinnati, OH 45268. **TREATMENT TECHNOLOGIES FOR PERCHLORATE REDUCTION.**

A variety of treatment technologies may be used for remediation of sites (soil or water) and treatment of potable water contaminated with perchlorate. Perchlorate's high activation barrier to chemical reduction and problems with available reductants mean that this technique is an unlikely candidate for eventual implementation. However, techniques based on biological, biochemical, or electrochemical reduction (in the redox sense), as well as physical separation processes, are expected to figure heavily into treatment strategies. All techniques possess a number of advantages and disadvantages. These relate to cost, maintenance, ease of implementation, reliability, and other factors-all of which must be evaluated in terms of total water quality. A number of general considerations for drinking water treatment must be brought to bear before any treatment technology can be successfully implemented. It is unlikely that any one technique will demonstrate itself to be an outstanding solution to this problem, but rather that a combination of techniques tailored to the needs of an individual system will provide an individual solution. The fundamental chemical and physical properties of the perchlorate ion, in addition to the nature and magnitude of the contamination, require insightful and carefully constructed solutions. Applying these technologies and strategies to real systems is a complex task that remains exploratory and developmental at this time.

van der Rijt, G.A.J. - Dptm of Com, KUN, PO Box 9104 6500 HE Nijmegen, Holland. **CONTRIBUTION OF INTERPERSONAL COMMUNICATION TO THE EFFECTS OF A CAMPAIGN ON WORKING SAFELY**

In a research on the effects of a Dutch nation-wide campaign about working safely with carcinogenic substances (see Moonen, Van der Rijt et al., *Safety Science*, 21 (1995), 131-144), we found considerable positive effects on knowledge and behavior in the target group. We found also significant effects on the amount of interpersonal communication about the issue with colleagues, the management and others (e.g. others: the company doctor). In view of a well-known communication 'law', which states that behavioral effects are to be expected with interpersonal communication rather than with mass media communication, we hypothesized, that behavioral effects might be due to the arousal of interpersonal communication by the campaign. In this paper we will test this assumption. Our expectation was that the effect of the campaign on behavior would appear to be spurious if we should take into account the effects on the interpersonal communication. Results of the test point in this direction. Effects of the campaign on behavior disappear or become weaker, when the effects on interpersonal have been controlled for. More unexpectedly we found that some of the knowledge effects disappeared too as a result of the control. These findings suggest a major role for interpersonal communication in safety campaigns and therefore that it is important to try to generate interpersonal communication in such campaigns. [This research is supported by the a grant of the Dutch Cancer Society]

Veilleux, A. L. - Shannon & Wilson, Inc. 400 North 34th Street, Suite 100, Seattle, WA 98103 Garlock, T.J. - Shannon & Wilson, Inc. 400 North 34th Street, Suite 100, Seattle, WA 98103 Birkner, P.D. - Shannon & Wilson, Inc. 400 North 34th Street, Suite 100, Seattle, WA 98103. **ESTIMATING SUBSISTENCE INGESTION RATES OF MOOSE AND CARIBOU IN A REMOTE VILLAGE IN ALASKA**

A subsistence-hunting scenario was evaluated as part of a baseline human health risk assessment at a military installation in a remote area of Alaska. This evaluation was needed to determine